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DISTILLATE BURNERS

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INTRODUCTION

Several years ago the Department of Agriculture conducted an investigation of oil burners for domestic heating.[1] So-called "hot-plate type" vaporizing burners reported on at that time were far from satisfactory in operation, and not in extensive use. More recently a much more satisfactory type, known as the "distillate" type burner, has been produced and used with apparent success. It differs from the ordinary house-heating oil burner in that it must use lighter oil as fuel but does not require a motor, a blower, nor an oil pump for its operation. On the other hand, it differs from the wick type of oil stove in the way the fuel is vaporized and in its larger heating capacity. It has been called also the "range" oil burner because of its relatively extensive use in kitchen ranges.

Uses of the distillate oil burner range from the heating of small garages to the heating of complete homes of moderate size. This publication, however, discusses only the following principal uses: (1) For kitchen ranges; (2) for heating stoves and circulator heaters; (3) for domestic water heating; (4) for complete house-heating and air-conditioning, to a limited extent.

The purpose of this bulletin is to supply reliable information to prospective purchasers of this type of heating equipment. The material is based principally on results of tests of burners of various designs conducted by the Bureau of Agricultural Engineering.

DESCRIPTION OF BURNER OPERATION

The operation of one type of distillate oil burner will be described by reference to figure 1, which shows a double burner such as may be installed in a kitchen range or circulator heater. The left-hand burner

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[1] United States Department of Agriculture Circular 405, The Domestic Oil Burner. For sale by the Superintendent of Documents, Washington, D.C., price 10 cents.

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is shown in section, to facilitate description of operation. The burners are mounted on a stand which rests on three leveling screws, because the burners must be level and at the same height. The oil is fed into each burner at the base as shown, and the flow is controlled by valves in the oil line which are not shown in this cut. The kindlers are small wicklike rings of noncombustible material used in lighting the burners. The burner sleeves are perforated to admit air [2] into the spaces above the kindlers and between the pairs of burner sleeves.

To light the burners the oil is turned on enough to saturate the kindlers and then the feed is temporarily shut off. Next the kindlers are lit with a long torch or taper thrust between the burner sleeves, and after the flame builds up the fuel-control valves are adjusted. At first the flame burns directly off the kindler as would be the case with an ordinary lamp wick, but as soon as the sleeves and base become hot the oil vaporizes and mixes with air that is entering through the perforated cylinders, thus forming a gas mixture which burns some distance above the kindlers. If enough oil is turned on the flame will extend well above the tops of the sleeves, but there are fairly definite limits within which good combustion occurs. The oil will be burned cleanly and without appreciable odor if the flame is neither too high nor too low. Manufacturers give specific instructions as to the proper heights of flame for their burners, and these should be followed for best results.

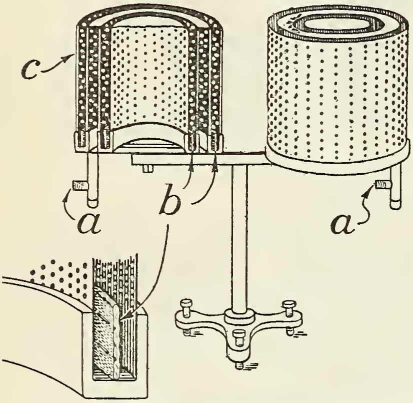

FIGURE 1.—A distillate burner of representative type: *a*, Oil inlet; *b*, kindlers; *c*, sleeves.

The most common method of igniting a distillate burner is by means of a lighted torch or taper inserted from the top down into the space between the pair of burner sleeves. Another scheme employs a porthole in the burner sleeves through which the lighted taper is introduced. This makes ignition easier, particularly in circulator heaters in which it is often difficult to insert the taper from the top of the sleeves. Electric igniters have been applied to some of the distillate burners, but the test work conducted by the Bureau of Agricultural Engineering did not include a study of these devices.

FUELS

For trouble-free and satisfactory operation of a distillate oil burner the fuel should be easily vaporized and should leave a minimum of carbon in the vaporizing grooves and on the kindlers and other burner parts. The three fuels which have been recommended for distillate burners by the manufacturers are kerosene, a special so-called "range burner" oil, and no. 1 domestic fuel oil. No. 1 domestic fuel oil is the lightest of the several grades that are ordinarily supplied for the power-type oil burners. More detailed data on oil fuels is contained in Department of Agriculture Circular 405, The Domestic Oil Burner.

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[2] An interesting fact in connection with the burning of oil is that more than 14 pounds of air are required for complete combustion of 1 pound of oil. While only the oxygen of the air is actually consumed, it may be stated loosely that the burner is using only 7 percent of oil and 93 percent of air.

All of the oils mentioned above contain practically the same amount of heat per gallon, but the range burner oil and the no. 1 fuel oil are generally somewhat cheaper than kerosene. Some manufacturers advise strongly against the use of no. 1 fuel oil, principally because of the formation of hard carbon in the kindlers and also because of less satisfactory operation in general. The Bureau found that, even in some burners for which no. 1 fuel oil is recommended by the manufacturers, considerably more attention was required when burning it than when kerosene was used. The use of a good grade of no. 1 fuel oil, however, may prove satisfactory if the user is willing to give the burner the added cleaning that is invariably required.

RANGE BURNERS

The usual method of installing the distillate oil burner in the ordinary kitchen range is shown in figure 2. (Wick-type oil stoves and special oil-burning ranges that have been put on the market recently have not been tested by the Department and are not discussed in this bulletin.) The burners, usually two but sometimes more, are placed in the fire box and replace entirely the ordinary coal or wood grate. The fire brick or cast-iron fire-box linings are usually removed; in fact, many distillate-burner manufacturers insist on the removal of the linings before their burners are installed. Outside and close to the range are the oil tank and the oil-control valves. The height of the tank must be adjusted to obtain a sufficient flow of oil to supply the burners and at the same time avoid dangerous overflow of oil from the burner base. When this level for the tank is once established, it is not generally necessary to change it.

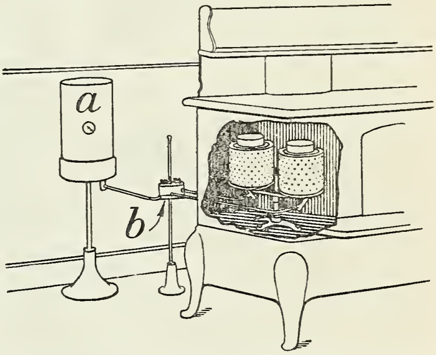

FIGURE 2.—Typical installation of a distillate burner in a kitchen range: *a*, Oil tank; *b*, oil-control valves.

It is necessary to provide a chimney connection for distillate burners used for cooking or house heating. Water heaters, however, burn at a low rate, and if in a room not used by the family need not necessarily be connected to a chimney.

To light hand-ignited types of burners, it is necessary to remove the stove lids and insert a lighted taper down within the burner sleeves in order to make contact with the kindlers. There are certain precautions to be taken in doing this; for example, oil must not be turned into a burner while it is hot but not ignited. Most manufacturers issue instructions with each burner sold or installed, and it is imperative that these instructions be read carefully and observed strictly.

The oil tank pictured in figure 2 holds about 2 gallons and is filled by hand. In order to obviate this more or less troublesome procedure, large storage tanks and pumps for oil may be used. The tank may be placed in the basement or some other convenient location and connected by piping to the small tank at the range. The fuel may be pumped from the large tank to the small one either by hand as needed, or by an electric pump which performs the task automatically, so that there is no need for the householder to be concerned about any oil reserve except that in the main tank. In addition to the convenience of the tank and pump installations described, the larger storage is of considerable value when weather or other conditions interfere with frequent replenishment of the fuel supply.

Kitchen ranges are used for cooking, for heating water, and for heating rooms in cold weather. The prospective purchaser of a distillate oil burner for the kitchen range naturally desires to know how efficiently oil fuel can perform these tasks.

The question of oven performance is probably of first importance to the average housewife. The speed of heating, the uniformity of oven temperature, and the ease of control are all important considerations. The studies by the Department of Agriculture show that there is no material difference in the speed of heating the oven or in uniformity of temperature when using the distillate burner in the ordinary kitchen range as compared with burning coal, using corncobs or light kindling wood for starting the fire, but at best these ranges are sluggish in this respect when compared with modern gas or electric ranges. In the control of oven temperatures, the oil-burning ranges have some advantage over the coal-burning ranges.

In cooking on top of the range, the distillate oil burner should prove satisfactory although it does not give as high top temperatures, particularly directly over the fire pot, as can be obtained in burning coal.

In many instances the kitchen range serves as a room heater, and may be the only heater used. This investigation showed that the oil-burner range serves as effectively as a coal range in this important respect. In other words, the same amount of space can be heated by the kitchen range when a satisfactory oil burner of suitable capacity is installed as can be heated when burning coal under ordinary conditions.

The amount of water heated by a range equipped with a water back or water reservoir when burning oil will probably prove adequate during the portion of the year when the range is operated continuously. When used only for cooking and therefore operated intermittently, during the warmer seasons, this quantity may not prove adequate. However, under such conditions the amount of water heated may be increased to almost any desired practical degree by installing a special water coil fitted around one or more of the burner units. Such coils can be used with any of the standard range burners, and are more effective than the ordinary range water back or hot-water reservoir.

COST OF OPERATION

The relative cost of coal and oil fuel is generally important. Comparisons of the costs of coal and oil in the kitchen range are presented in tables 1 and 2. During the colder months of the year the range serves as a heater as well as for cooking purposes and therefore its operation is practically continuous, whether the fuel is oil or coal; because when there is no demand for heat for cooking, there is still the necessity for heating the house. The comparisons of costs for the colder months are given in table 1. During the warmer months, if coal is burned in the kitchen range the fire is usually banked between cooking periods or permitted to go out and a new one is made when cooking is resumed. The oil burner is of greatest advantage at such times because it can be turned off and relighted with a minimum of trouble. Comparisons of the cost of the two kinds of fuel under such conditions are shown in table 1. (The figures given in table 1 can be only rough approximations because of the difficulty, when burning either coal or oil, of determining the fuel demands with intermittent use of the range.)

TABLE 1.—*Cost of oil fuel as compared to cost of coal*

FOR WINTER OPERATION (HOUSE HEATING) OF ORDINARY KITCHEN RANGE, PARLOR STOVE, OR SIMILAR EQUIPMENT

Coal price per 2,000 pounds (dollars)	Increased expense of using oil when priced at—			
	8 cents per gallon	10 cents per gallon	12 cents per gallon	14 cents per gallon
4	3¾ times	4¾ times	5¾ times	6¾ times.
6	2½ times	3¼ times	3¾ times	4½ times.
8	2 times	2½ times	3 times	3⅓ times.
10	½ more	2 times	2⅓ times	2¾ times.
12	¼ more	⅔ more	2 times	2¼ times.
14	⅒ more	⅓ more	⅔ more	2 times.
16	Equal	¼ more	½ more	⅔ more.
FOR SUMMER OPERATION (COOKING) OF ORDINARY KITCHEN RANGE				
4	¾ more	2¼ times	2¾ times	3⅐ times.
6	¼ more	½ more	¾ more	2⅒ times.
8	⅒ less	⅛ more	⅓ more	½ more.
10	¼ less	⅒ less	⅒ more	¼ more.
12	⅖ less	¼ less	⅒ less	Equal.
14	½ less	⅓ less	¼ less	⅒ less.
16	4⁄7 less	½ less	⅓ less	⅕ less.

The following example illustrates the use of table 1: In a certain farm home the kitchen range is being used for cooking in the summer season and for cooking and heating in the winter season. Hard coal at $12 per ton is being burned. The householder is contemplating the change to oil fuel and desires to know what the difference in fuel cost would be with oil at 8 cents per gallon. Table 1 states that the oil would cost, during the winter season, about one-fourth more than the coal. In other words, if he is using $50 worth of coal during the winter he would probably use $63 worth of oil, at the prices indicated. However, the conditions in summer would be altered somewhat; assuming that $12 worth of coal was consumed during the summer months, the equivalent in oil would be, according to table 1, about two-fifths less in cost than the coal or about $7. This relatively better showing of the oil in summer is due to the fact that the oil burner can be shut off when not needed, as already pointed out. Taking the year-round costs for the above conditions, the coal would cost $62 and the oil $70, or a yearly excess for the oil above coal of about 13 percent. If the oil costs 10 cents per gallon, the costs would be $50 for coal in the winter and $83 for oil during the corresponding period, according to table 1, and would be $12 for coal in the summer against $9 for oil. The yearly costs for coal under these conditions would then be $62, against $92 for oil, or an excess of 48 percent for the oil. The difference in cost is somewhat greater when soft coal is burned because of the lower price of soft as compared with hard coal.

SPACE HEATERS

One of the earliest applications of the distillate oil burner was for heating one or more rooms, small assembly halls, garages, churches, etc., by means of the ordinary stove-type heater. The grates were removed from the stove and one or more distillate burners put in the fire pot. These were fed oil from a small adjacent oil tank in the same manner as the range burner in figure 2. Also, about the same time, the burners were used to replace solid fuel in the so-called parlor or circulator heaters. Soon after these early conversions of such heaters for burning oil, special oil-burning types were manufactured.

Figure 3 shows one of the simplest of the special oil-burning stoves, such as would be used for heating one or more rooms, a garage, or a similar space. In the particular stove shown in figure 3 the entire mechanism and oil-storage tank are assembled into a single unit, and except for the chimney connection the stove could be moved about at will. In the type shown, the oil-storage tank is fastened to the back of the heater and is filled by hand, although this type can also be hooked up with the larger oil-storage tank by means of a pump as already described (p. 3). The burner is ignited by means of a lighted taper in the same manner as in the range burner. The flame is adjusted by hand by means of a small control valve or valves. The automatic oil-level control valve indicated in figure 3 normally requires no adjustment or attention.

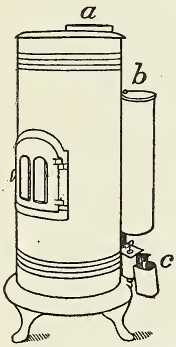

FIGURE 3.—A small radiant-type stove with distillate burner: *a*, Outlet for gases to chimney; *b*, oil tanks; *c*, oil-control valve.

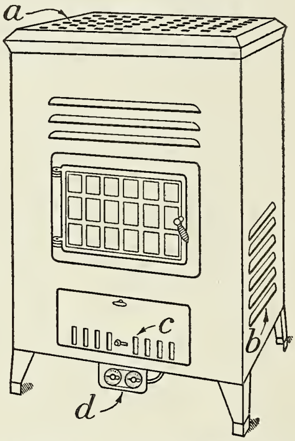

FIGURE 4.—A circulator heater with distillate burner: *a*, Warm-air outlet; *b*, cold-air inlet; *c*, adjustable air ports; *d*, oil-control valves.

The space heater shown in figure 4 is somewhat more attractive in appearance than is the single stove just described. It is ordinarily made in larger capacities than the stove shown in the other figure. The general operating principles are similar, except that direct radiation from the fire pot is cut off by the enameled casing. The air to be heated enters the heater through the cold-air inlet and leaves it through the warm-air outlet at the top, as indicated. The oil-control valves are shown on the lower front of the cabinet. The fuel tank for this type of heater is generally of about 3 gallons capacity, although larger oil supplies can be stored in basement tanks. These heaters are made in rather large capacities; in fact, some of this type will heat a well-constructed house of 7,500 cubic feet volume to a temperature of 70° F. with an outside temperature of 10°.

COST OF OPERATION

As in the case of the range, the average householder is interested in the cost and efficiency of heating with oil as compared with heating with coal. The tests conducted by the Department indicate that the efficiency of the well-designed oil-burning heater compares favorably with that of the coal-burning types. Table 1 gives the comparative costs of heating by means of oil and by means of coal.

In order to illustrate the use of table 1 in this connection, let it be supposed that a man is using 3 tons of coal per winter in a parlor heater and the price of coal is $12 per ton. He desires to know what difference in fuel cost would result if he installed an oil-burning circulator heater for which he can obtain range burner oil at 10 cents per gallon. According to table 1, for oil at 10 cents per gallon and coal at $12 per ton, the oil would cost about $60 per season or $24 more than coal. On the other hand, if he can obtain suitable range burner fuel at 8 cents per gallon the oil heat would cost only about $45 per season as compared with $36 for coal.

While the Department's tests did not include an actual study of heating by gas and electricity, enough is known of the performance of gas and electric heaters to permit the preparation of table 2 showing comparative costs of heating with oil and gas. These comparisons hold only for those types of gas heaters in which the burned gases discharge into a chimney, and not for the portable radiant gas heaters that are in common use. The figures in the first part of table 2 are for gas containing 500 heat units per cubic foot, which approximates the heat value of the average manufactured gas, whereas the figures in the second part of the table are for gas containing 1,000 heat units per cubic foot, which approximates the heat value of some of the natural gases.

TABLE 2.—*Cost of oil fuel as compared to cost of gas for operating parlor stoves, water heaters, and similar devices*

MANUFACTURED GAS (500 HEAT UNITS PER CUBIC FOOT)

Gas price per 1,000 cubic feet (dollars)	Increased or decreased expenses of using oil when priced at—			
	8 cents per gallon	10 cents per gallon	12 cents per gallon	14 cents per gallon
0.50	⅝ as much	¾ as much	⅒ less	⅒ more.
1.00	⅓ as much	⅖ as much	½ as much	4/7 as much.
1.50	⅕ as much	¼ as much	⅓ as much	⅖ as much.
NATURAL GAS (1,000 HEAT UNITS PER CUBIC FOOT)				
0.25	2½ times	3 times	3¾ times	4⅓ times.
0.75	⅙ less	Equal	¼ more	½ more.
1.25	½ less	⅜ less	¼ less	⅛ less.

It is absolutely essential that a heater be selected of sufficient capacity to heat the house or portion of a house satisfactorily when the outside weather conditions are most severe. Furthermore, the heater should have some reserve capacity to raise the room temperature fairly quickly. Table 3 gives the required oil-burning capacity of a heater of good design and efficiency to maintain a temperature of 70° F. inside a well-built home under the various outside temperatures indicated. A poorly built house, of course, will require a heating unit of larger capacity. Also, an inefficient heater must be of larger capacity than indicated in the table because it will not utilize the heat in the oil to best advantage.

TABLE 3.—*Minimum quantity of oil that must be burned with good efficiency to maintain a temperature of 70° F. inside houses of average-quality construction against different outside temperatures*

Volume of house excluding cellar (cubic feet)	Pints of oil required per hour when outside temperature is—				
	+20 °F.	+10 °F.	0 °F.	−10 °F.	−20 °F.
1,000	0.5	0.6	0.7	0.8	0.9
2,000	.9	1.1	1.3	1.5	1.7
3,000	1.4	1.7	2.0	2.2	2.5
4,000	1.9	2.2	2.5	3.0	3.3
5,000	2.3	2.8	3.2	3.6	4.2
6,000	2.8	3.3	3.9	4.4	5.0
7,000	3.3	3.9	4.5	5.2	5.8
8,000	3.7	4.4	5.2	5.9	6.6
9,000	4.2	5.0	5.8	6.7	7.5

CENTRAL HEATING PLANTS

The distillate oil burner, in its most recent adaptation, has been applied to the heating of complete homes of small or medium size. The commonest application of this sort has been in the warm-air type of system although some installations in small hot-water systems have also been made. The distillate burner is being installed in both pipeless and pipe types of warm-air systems.

Such distillate-burner furnaces are available in sizes ranging from those suitable for the smallest bungalow to those which will heat a 10-room house of good construction. The largest sizes contain more than one burner unit. These furnaces consume the same grade of fuels as do the ordinary range burner, that is, kerosene, special range-burner oil, or no. 1 domestic fuel oil. Larger fuel-storage tanks are desirable for use with the complete house-heating burners; generally one of 275 gallons capacity or larger is installed.

WATER HEATING[3]

The use of the distillate oil burner for domestic water heating is one of the most recent applications of this type of oil burner. Heating water automatically has probably been done most effectively thus far by means of gas and electricity, but in many localities the cost of electricity for heating is prohibitive, and in most rural sections gas is not available. The distillate-burner type of water heater gives promise of a convenient and economical means of obtaining hot water, in some instances with automatic control of the temperature.

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[3] Information regarding other methods of heating water is contained in Farmers' Bulletin 1426, Farm Plumbing.

There are two principal types of distillate burner water heaters, the side-arm and the storage heaters. The side-arm type consists generally of a single burner which transmits its heat to a coil of copper pipe attached to the side of a hot-water tank or boiler. The water to be heated passes through the heated copper pipe and into the tank where the hot water is stored for use. In the storage-type heater (fig. 5) the tank that contains the stored hot water is mounted directly above the oil burner, and the hot gases from the flame are passed between the tank and an outer shell or through a central flue which connects the top and bottom heads of the tank. The storage tanks of this type of heaters are insulated to lessen the loss of heat by radiation. Sometimes an additional coil is built into the storage-type heater in order to make it a so-called "instantaneous" heater. Both the side-arm and the storage types of heaters generally have storage capacities of from 20 to 30 gallons. The hourly heating capacity together with this storage capacity is sufficient to take care of the hot-water demand of most homes.

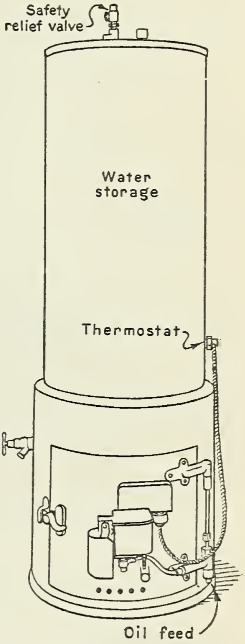

FIGURE 5.—Storage waterheater equipped with distillate burner.

Distillate type water heaters may be controlled either manually or automatically. In the manually controlled type, when the temperature of the stored water is too low the burner is lighted or the flame is increased, and when the water temperature rises too high the flame must be cut down, by hand. Some designs of manually controlled water heaters are equipped with a pilot flame which is just sufficient to keep the tank of water hot when there is a minimum use of the water. When more hot water is required the flame is increased, by hand.

One type of completely automatic storage water heater is shown in figure 5. In this design no attention except occasional filling of the oil tank is necessary. The thermostat shown in the figure serves to open or close an oil valve mounted on the swinging door. In this particular design there is an oil-pilot flame which burns at all times and ignites the oil in the main burner whenever the thermostat causes the oil-feed valve to be opened. Where gas is available, this oil-pilot flame may be replaced with a small gas-pilot flame. The cold-water inlet and hot-water outlet connections to the top of the tank are shown clearly, together with the safety-relief valve which prevents building up dangerous pressures in the water heater. A relief valve should be installed on all hot-water heaters. Manufacturers of water-heating equipment either supply relief valves or make recommendations for installation of them.

The constant-level device which maintains the proper oil level in the burner is also mounted on the door of this heater, and seldom requires any adjustment once it has been set properly. Relatively large oil-storage tanks may be installed with water heaters, as with the other types of range-burner applications already described.

Comparisons of the cost of oil fuel with coal, manufactured and bottled gas and electricity for water heating, are given in tables 2, 4, 5, and 6

TABLE 4.—*Cost of oil fuel to operate automatic storage water heater as compared with cost of coal to operate small cast-iron water heater*

Coal price per 2,000 pounds (dollars)	Increased or decreased expense of using oil when priced at—			
	8 cents per gallon	10 cents per gallon	12 cents per gallon	14 cents per gallon
8	⅓ more	⅗ more	2 times	2¼ times.
10	Equal	⅓ more	½ more	⅘ more.
12	⅛ less	⅒ more	⅓ more	½ more.
14	¼ less	1⁄11 less	⅒ more	⅓ more.

TABLE 5.—*Cost of oil fuel as compared with cost of bottled gas (propane) for operating automatic storage water heater* [1]

Gas price per 100 pounds (dollars)	Decreased expense of using oil when priced at—			
	8 cents per gallon	10 cents per gallon	12 cents per gallon	14 cents per gallon
10	⅐ as much	⅕ as much	2⁄9 as much	¼ as much.
12	⅛ as much	⅙ as much	⅕ as much	⅕ as much.
14	⅑ as much	⅐ as much	⅙ as much	⅙ as much.
16	⅒ as much	⅑ as much	⅐ as much	⅙ as much.

[1] The cost of bottled gas as compared to cost of oil is less when used for cooking than when used for heating water.

TABLE 6.—*Cost of oil fuel as compared with cost of electricity to operate automatic storage water heater* [1]

Electricity price (cents)	Decreased expense of using oil when priced at—			
	8 cents per gallon	10 cents per gallon	12 cents per gallon	14 cents per gallon
Per kilowatt-hour				
1	2⁄7 as much	4⁄11 as much	8⁄19 as much	½ as much.
2	⅐ as much	2⁄11 as much	4⁄19 as much	¼ as much.
3	1⁄11 as much	2⁄17 as much	⅐ as much	⅙ as much.
4	1⁄14 as much	1⁄11 as much	2⁄19 as much	⅛ as much.
5	1⁄18 as much	1⁄14 as much	1⁄12 as much	⅒ as much.

[1] The cost of electricity as compared to cost of oil is less when used for cooking than when used for heating water.

CHIMNEYS

While the distillate burner, in any of its uses described herein, requires comparatively little draft, certain chimney standards must be met if satisfactory operation is to be attained. There must be sufficient draft in the chimney to remove the products of combustion effectively, and the chimney should be so built as to be free from down drafts.[4] Manufacturers of distillate burners specify the size of chimney flue required by their equipment.

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[4] More detailed information regarding this subject is contained in Farmers' Bulletin 1649, Construction of Chimneys and Fireplaces.

Ideal practice requires a separate flue for each heating unit in the house, and this practice should be followed in connection with distillate burners even though comparatively little draft is required. The draft should be nearly uniform for most satisfactory results. The use of an automatic draft regulator will offset to some degree the ill effects of connecting more than one heating unit to the same flue, and a well-designed draft regulator might well be a part of every distillate-burner installation. Such regulators are simple and inexpensive and are offered by many manufacturers of distillate burners.

SELECTION AND CARE OF EQUIPMENT

The equipment selected should be of ample capacity to perform the task at hand, whether it be the firing of a kitchen range, the heating of water, or the heating of a portion or the whole of a house. The more reputable manufacturers have given sufficient study to their products to enable them to recommend correctly the distillate burner required for particular conditions.

Certain parts of distillate-burner equipment are exposed to high temperatures and to some corrosive effect from the burning of the fuel, and those parts should be constructed of materials that will withstand such effects. There is no way, however, for the average purchaser to know whether suitable materials are used, and again he must rely upon the integrity of the manufacturer.

It is always the best plan to have the installation of distillate-burning equipment made, or at least inspected, by an experienced oil-burner mechanic. If installation is made by a man who has had no previous oil-burner experience, special care should be taken to see that the job is done in strict compliance with the printed instructions accompanying the equipment. Hazards of all kinds should be reduced to a minimum.

It is not feasible to give detailed instructions for the care of all types of distillate-burner equipment. It seems practicable, however, to itemize several of the more important general points with reference to the equipment under discussion:

1. Read the manufacturers' instructions and keep them handy.
2. Use a proper grade of oil.
3. When the burner operates abnormally, follow the instructions. Follow instructions of manufacturers carefully regarding lighting burners and adjusting dampers.
4. Replace the kindlers periodically. Lighting of burners is done most easily when the kindlers are in good condition.
5. Clean the burners periodically.
6. Use discretion in making any changes in adjustment. particularly with reference to the level of the oil in the burner grooves.
7. Clean the stove pipe before installation, and afterward if excessive soot is produced at any time.

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